

REMARKS

This Preliminary Amendment cancels, without prejudice, claims 1 to 20 in the underlying PCT Application No. PCT/EP2004/010795 and adds new claims 21 to 40. The new claims, inter alia, conform the claims to United States Patent and Trademark Office rules and does not add any new matter to the application.

In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to United States Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. §§ 1.121(b)(3)(ii) and 1.125(c), a Marked-Up Version of the Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

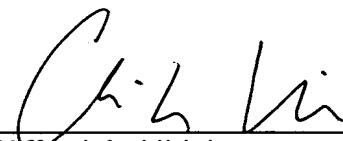
The underlying PCT Application No. PCT/EP2004/010795 includes an International Search Report, dated January 21, 2005, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

It is respectfully submitted that the subject matter of the present application is new, non-obvious and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

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ROTARY KNOB FOR A MOTOR VEHICLE

FIELD OF THE INVENTION

The present invention relates to a rotary knob for operating a motor vehicle by rotating the rotary knob.

5 BACKGROUND INFORMATION

Such a Certain rotary knob is known knobs are described, for example, from ~~DE~~ in German Published Patent Application No.

101 39 693 [[A1]]. According to [[DE]] German Published Patent Application No. 101 39 693 [[A1]], in the context of modern

10 electronic devices in a vehicle that constantly offer additional functions with more and more options, multi-function operating elements, by which various functions of the connected devices can be performed, have been produced because of the limited installation space for the associated operating 15 elements. Thus, ~~EP~~ European Published Patent Application No.

0 366 132 [[B1]] describes, for example, a multifunction operating device for motor vehicles, where function groups and individual functions are selected with the aid of a rotary switch, and where an ENTER function can be triggered[[;]], one 20 and the same bidirectional rotary switch being used for selecting menus and individual functions. This rotary switch has click-stop positions, to which menus or individual functions are assigned, the ENTER function being able to be initiated by an axial motion of the rotary switch. Such a

25 multifunction operating device is used, for example, to enter the destination of a navigation system. To this end, an alphanumeric keyboard is illustrated on a display unit, the user being able to move forwards and backwards in the alphanumeric keyboard with the aid of the bidirectional motion 30 of the rotary switch. When the cursor is then situated on the desired alphanumeric character, the latter can be selected by an axial motion of the rotary switch and transferred into the

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MARKED-UP VERSION OF THE
SUBSTITUTE SPECIFICATION

navigation system. From DE German Published Patent Application No. 199 41 960 A1, it is also known describes that an operating element can be designed as a cylinder, which is bidirectionally rotatable about its longitudinal axis and 5 elastically movable with respect to the longitudinal axis.

For convenient operation, and in order to simplify operating haptics, [[DE]] German Published Patent Application No. 101 39 693 A1 proposes describes that a bidirectional rotary 10 element be formed, having an axis of rotation extending in a direction essentially parallel to a vehicle-part surface. Using the bidirectional rotary element, a bidirectional preselection and/or selection of function groups and/or functions is made within a menu level. Selection of the menu 15 planes is accomplished via a second operating device. The second operating device can be implemented by moving the bidirectional rotary element parallelly to the axis of rotation of the bidirectional rotary element. To form the second operating device, a further variant provides for the 20 bidirectional rotary element taking the form of a rocker in the direction of the axis of rotation. Another solution provides a second operating device, which has two operating elements that are preferably manipulable in a direction parallel to the axis of rotation of the bidirectional rotary 25 element. The second operating device is situated on or at least partially in the bidirectional rotary element and constitutes a unit with the rotary element. In addition, the bidirectional rotary element is designed for preselection and/or selection in two directions on the indicating 30 apparatus, and the second operating device is designed for selection in two further directions, preferably perpendicular to the selection directions of the bidirectional rotary element.

~~Also known from DE~~ described in German Published Patent

Application No. 31 04 384 [[A1]] is an electrical-unit switch having displays, where a counter records the circuit state brought about by manually operating a freely accessible rotary 5 not, and supplies it to a stationary, electronically functioning display field in accordance with the count, the display field and the rotary knob being situated close together, and a switching contact, which is operated by an actuating shaft supporting the rotary knob, interacting with 10 the counter. In this context, it is possible to look at the rotary knob and display at the same time, since the electronic display field is built into the rotary knob on its front end face, the electronic display field being supported by a connecting piece projecting above the rotary knob in the 15 rearward axial direction, and the front end face of the rotary knob being essentially transparent all around.

In addition, a push-button switch having a housing and a switching part displaceably supported in it is ~~known from EP~~ 20 described in European Published Patent Application No.

0 329 920 [[A1]]. A pushbutton cap used as a manipulating element has a base part having a tubular extension latched to the switching part, and a removable, at least partially transparent, protective cap. An LED or LCD display element 25 having at least one light-emitting diode and/or one liquid-crystal display is situated in a cavity delimited by the base part and the protective cap, the LED or LCD display element being essentially formed by a wafer that is right-angled in the sliding direction of the pushbutton cap, and even being 30 provided with electrical terminals.

A rotary knob is also ~~known from EP~~ described in European Published Patent Application No. 0 771 681 [[A2]].

~~The object of the present invention is to further improve the operation of a motor vehicle.~~

SUMMARY

~~The above-mentioned object is achieved by According to an example embodiment of the present invention,~~ a rotary knob ~~is~~ for operating a motor vehicle by rotation of the rotary knob, the rotary knob having a (an at least) partially transparent display layer that rotates along in response to an angular movement of the rotary knob, and a controllable light source for displaying changeable information on the display layer or for projecting the changeable information onto the display layer. ~~In an advantageous refinement of the present invention, the The rotary knob has may have~~ an axis of rotation, which is aimed to a considerable extent, or essentially aimed; at an observer. ~~In an advantageous manner, an An axis of rotation~~ [[is]] may be essentially orthogonal to the display layer.

~~In a further advantageous refinement of the present invention, the The display layer has may have~~ a side facing an operator and a side facing away from the operator, the side facing away from the operator being able to be illuminated by the controllable light source. In this context, light may be projected onto the side of the display layer facing away from the operator, in the form of an image that is visible on the side of the display layer facing the operator.

~~In a further advantageous refinement of the present invention, the The controllable light source [[is]] may be~~ situated optically in back of the display layer, ~~in particular e.g.,~~ at a distance of 2 cm to 7 cm away from the display layer, as viewed from the side of the display layer facing the operator.

~~In a further advantageous refinement of the present invention, the The controllable light source includes may include~~ a laser.

In a further advantageous refinement of the present invention,
a A movable light beam (whose point of incidence on the
display layer is changeable) may be produced by the
5 controllable light source.

In a further advantageous refinement of the present invention,
the The rotary knob has may have a scattering lens situated
between the controllable light source and the display layer.

10 In a further advantageous refinement of the present invention,
a A reflecting mirror, in particular e.g., a curved one for
deflecting a light beam [[is]], may be (optically) situated
between the controllable light source and the display layer.

15 In a further advantageous refinement of the present invention,
a A prism for bending a light beam, in particular e.g., one
having a curved reflecting surface, [[is]] may be (optically)
situated between the controllable light source and the display
20 layer.

The above mentioned object is also achieved by According to an
example embodiment of the present invention, an operator
device is for operating a motor vehicle, having at least two
25 above-mentioned rotary knobs which [[are]] may be functionally
usable independently of each other in an advantageous
refinement of the present invention. In this context, a
further advantageous refinement of the present invention
provides for different Different information items being may
30 be simultaneously displayable on the display layers of the
rotary knobs. In accordance with the present invention, the
The same time can may mean the same time in the strict sense
of the word, but the same time in the sense of the present
invention can context may also include different points in
35 time, which are so close together that the human eye perceives

images, which it sees at these different points in time, as simultaneously displayed images.

~~In a further advantageous refinement of the present invention,~~
5 the The rotary knobs may have a common light source for displaying, ~~in particular e.g.,~~ different information items on their display layers.

~~The above mentioned object is also achieved by a~~ In a
10 multifunction operating device for a motor vehicle, the multifunction operating device ~~having~~ may have a display and an above-mentioned rotary knob and/or an above-mentioned operator device for preselecting and/or selecting menu items representable on the display.

15 ~~In an advantageous refinement of the present invention, menu~~
Menu items, ~~in particular e.g.,~~ selected ones, which are representable or represented on the display, ~~are~~ may be simultaneously representable on the display layer.

20 ~~In addition, the above mentioned object is achieved by a~~ A motor-vehicle steering wheel, ~~which has~~ may include an above-mentioned rotary knob and/or an above-mentioned operator device.

25 ~~In an advantageous refinement of the present invention, at~~ At least one rotary knob [[is]] may be situated less than 4 cm, ~~in particular e.g.,~~ less than 3 cm away from an edge of the steering wheel.

30 ~~In addition, the above mentioned object is achieved by a~~ A motor-vehicle steering wheel, ~~which has~~ may include an above-mentioned rotary knob, an above-mentioned operator device, an above-mentioned steering wheel, and/or an above-mentioned
35 multifunction operating device.

A motor-vehicle within the meaning of the present invention is context may include, in particular e.g., a land vehicle that may be used individually in traffic. In particular, motor vehicles within the meaning of the present invention context are not restricted to land vehicles having an internal combustion engine.

Further advantages aspects and details are derived from the following description of exemplary embodiments. The figures show: features of example embodiments of the present invention are described in more detail below with reference to the appended Figures.

15 **BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is an internal view of a motor vehicle[;].

Fig. 2 is a cross-section cross-sectional view of an exemplary embodiment of a rotary knob[;].

20 Fig. 3 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[;].

25 Fig. 4 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[;].

Fig. 5 is a perspective plan view of a rotating body[;].

Fig. 6 is a perspective plan view of a rotating body[;].

30 Fig. 7 is a perspective plan view of a rotating body[;].

Fig. 8 is a perspective plan view of a rotating body[;].

Fig. 9 an exemplary embodiment of illustrates a multifunction operating device[[]].

Fig. 10 an exemplary embodiment of illustrates a screen form[[]].

Fig. 11 is a perspective plan view of a rotating body[[]].

Fig. 12 is a cross-section cross-sectional view of an exemplary embodiment of a rotary knob[[]].

Fig. 13 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 14 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 15 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 16 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 17 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 18 is a cross-section cross-sectional view of a further exemplary embodiment of a rotary knob[[]].

Fig. 19 is a cross-section cross-sectional view of an exemplary embodiment of an operator device; and.

Fig. 20 is a rear view of an exemplary embodiment of an operator device.

DETAILED DESCRIPTION

Figure 1, shows is an internal view of a motor vehicle 1 having a steering wheel 2. A display 3 situated in a console 4 and two rotary knobs 5 and 6 positioned on steering wheel 2 are situated in motor vehicle 1. Rotary knobs 5 and 6 are positioned approximately 3 cm away from an edge 7 of steering wheel 2. Alternatively, or in addition, rotary knobs may also be positioned in the region of console 4. In addition, operating elements 8 are situated in the region of display 3.

Fig. 2 shows is a cross-section cross-sectional view of a rotary knob 10 as an exemplary embodiment of rotary knob 5 and/or rotary knob 6; ~~rotary~~. Rotary knob 10 having has a rotating body 12, which includes an at least partially transparent display layer 14 that rotates along in response to an angular movement of rotary knob 10. Display layer 14 has a side 15 facing an operator and a side 16 facing away from the operator. ~~In an advantageous refinement, rotating~~ Rotating body 14 has may include an axis of rotation 18, which is essentially pointed at an observer. In this context, axis of rotation 18 ~~is advantageously~~ may be oriented essentially orthogonally to display layer 14.

Rotary knob 10 also has a controllable light source 19 for representing changeable information on display layer 14 or projecting the changeable information on the side 16 of display layer 14 facing away from the operator. In this context, light is projected onto the side 16 of the display layer 14 facing away from the operator, in the form of an image that is visible on the side 15 of display layer 14 facing the operator. Reference numeral 17 designates a side wall of the rotating body.

Controllable light source 19 includes a fixed light source 11 and a template 13, which may be changed by a changing

mechanism ~~not shown~~, different images being projectable onto display layer 14 by changing template 13.

Fig. 3 shows ~~is~~ a cross-section **cross-sectional view** of a 5 rotary knob 20 as an exemplary embodiment of rotary knob 5 and/or rotary knob 6 that is preferred in comparison with the exemplary embodiment according to Fig. 2. In this case, as in the case of the remaining figures, identical **Identical or similar** elements are designated by the same reference numerals. Rotary knob 20 likewise has a rotating body 12 having an at least partially transparent display layer 14, which rotates along in response to an angular movement of rotary knob 20. In addition, rotary knob 20 has a light source 21, which is controllable by a control unit 23 and has a laser 10 by which a light beam 22 is movable across display layer 14. Due to the inertia of the human eye, an image is made visible to the operator on the side 15 of display layer 14 facing the operator, by suitably switching light beam 22 on and off and rapidly moving light beam 22 across display layer 14. Seen 15 from the side 15 of display layer 14 facing the operator, controllable light source 21 is positioned optically behind display layer 14 at a distance d1 of, e.g., 2 cm to 7 cm away from display layer 14.

20 Light beam 22, which is produced by laser 24, is moved by a suitable mechanism, such as that is known described, for example, from PCT International Published Patent Application No. WO 03/0365553 and [[EP]] European Published Patent Application No. 1 168 231 [[A2]]. A controllable light 25 source 21 may be taken available, for example, from Symbol Technologies, Inc., Holtsville, NY 11742, U.S.A., or from Microvision, Inc., 19910 North Creek Parkway, Bothell, WA 30 98011, U.S.A. Further details of such controllable light sources may also be extracted from the Internet pages of

Symbol Technologies, Inc., e.g.,
www.symbol.com/products/oem/lpd.html.

The mechanism suitable for moving light beam 22, and laser 24,
5 may be spatially separated and, e.g., connected by an optical
waveguide.

Fig. 4 shows ~~is~~ a cross-section cross-sectional view of a
further, preferred exemplary embodiment of a rotary knob 30.
10 In this case, a scattering lens 31 is provided between
controllable light source 21 and display layer 14. When viewed
from the side 15 of display layer 14 facing the operator,
controllable light source 21 is likewise positioned optically
behind display layer 14, but at a distance d2 of, e.g., 1 cm
15 to 4 cm away from display layer 14.

Fig. 5 shows ~~is~~ a perspective plan view of rotating body 12 at
a time at which "TEMP 25°C" is displayed on display layer 14 by
light beam 22. Rotating body 12 may rotate in the direction of
20 double arrow 33, i.e., clockwise and counterclockwise. A
rotation of rotating body 12 is measured by a suitable
mechanism ~~not shown~~. An exemplary embodiment Exemplary
embodiments of such a mechanism ~~may be taken~~ are described,
for example, ~~from DE in German Published Patent Application~~
25 No. 31 04 384 [[A1]] or [[EP]] European Published Patent
Application No/ 0 771 681 [[A2]]. In the present exemplary
embodiment, the display "TEMP 25°C" on display layer 14
indicates a setpoint temperature of 25°C set by an air-
conditioning system. The setpoint temperature is decreased by
30 rotating rotating body 12 counterclockwise and increased by
rotating rotating body 12 clockwise. The corresponding, new
setpoint temperature is displayed on display layer 14.

Other languages may be set for the same functionality, using an operator device, which is for control unit 23 and is not shown in Fig. 6 and Fig. 7. In this context, not only Latin letters, but also complex characters, such as those shown 5 illustrated in Fig. 6 and Fig. 7, may be displayed by the rotary knob ~~of the present invention~~. Thus, rotating body 12 in Fig. 6 displays "Temperature 25°C" in the Korean language, and the rotating body in Fig. 7 displays "Temperature 25°C" in the Chinese language.

10 Other functions may also be set by the operator device or an additional operator device for control unit 23, ~~not shown in Fig. 6 and Fig. 7, or Fig. 8~~. Thus, Fig. 8 shows illustrates the use of rotating body 12 for adjusting a radio. In this 15 context, a received frequency or, as shown illustrated in Fig. 8, a selected radio station may be displayed on display layer 14. The received frequency or the selected radio station may be changed by rotating rotating body 12 clockwise or counterclockwise.

20 The operator devices ~~not shown in Fig. 6, Fig. 7, or Fig. 8~~ may be, for example, part of operating elements 8 represented illustrated in Fig. 1.

25 Figure 9 shows illustrates an exemplary embodiment of a multifunction operator device 40. In the present exemplary embodiment, multifunction operator device 40 has a rotary knob 20 or 30. However, only rotating body 12 is shown illustrated. Multifunction operating device 40 has a control unit 41 for 30 controlling controllable light source 21 and evaluating the angular position of rotating body 12.

In addition, display 3 and operating elements 8, or a part of operating elements 8, are components of multifunction

operating device 40. A multifunction operating device according to DE such as that as described in German Published Patent Application No. 101 39 693 [[A1]] is further developed with the aid of multifunction operating device 40 represented 5 illustrated in Fig. 9, rotary knob 20 or 30 replacing rotary element 11 of DE described in German Published Patent Application No. 101 39 693 [[A1]], and operating elements 8 or a part of operating elements 8 corresponding to softkeys 36 of [[DE]] German Published Patent Application No. 101 39 693 10 [[A1]].

Fig. 10 shows illustrates an exemplary embodiment of a telephone screen form 50, which corresponds to a display according to Fig. 6 of [[DE]] German Published Patent Application No. 101 39 693 [[A1]]. Reference numeral 51 15 designates a selected menu line or a selected menu item. It is provided that the content of a selected menu line, i.e., the selected menu item, is reproduced on display layer 14, as shown illustrated in Fig. 11. Thus, the content of selected 20 menu line 51 in Fig. 10 is the "telephone book" function, which is reproduced on display layer 14. By rotating rotating body 12 counterclockwise, selected menu line 51 is moved up, e.g., to the "telephone number" function. In this case, display layer 14 displays the words "telephone number". By 25 rotating rotating body 12 clockwise, selected menu line 51 is moved down, e.g. to the "messages" function. In this case, display layer 14 displays the word "messages".

In the exemplary embodiments according to illustrated in Fig. 30 2, Fig. 3, and Fig. 4, display layer 14 is flat. However, other geometric forms of the display layer are also possible. Thus, Fig. 12, Fig. 13, and Fig. 14 each show illustrate a cross-section of an exemplary embodiment of a rotating body 62, 72, and 82, respectively, having a convex display layer 64, a concave display layer 74, and a graded display layer 84,

respectively. Such rotating bodies 62, 72, and 82 may replace both rotating body 12 according to illustrated in Fig. 2, Fig. 3, and Fig. 4, and rotating bodies 12 and 212 according to illustrated in Fig. 15, Fig. 16, Fig. 17, Fig. 18, Fig. 19, 5 and Fig. 20.

Fig. 15 and Fig. 16 each show illustrate a cross-section of a further exemplary embodiment of a rotary knob 90 and 100, respectively, a light beam 92 and 102 being directed onto 10 display layer 14 with the aid of a mirror 91 and 101, respectively, which is positioned between controllable light source 21 and display layer 14. Mirror 91 of rotary knob 90 is flat, while mirror 101 of rotary knob 100 is curved.

15 Fig. 17 and Fig. 18 each show illustrate a cross-section of a further exemplary embodiment of a rotary knob 110 and 120, respectively, a light beam 112 and 122 being directed onto display layer 14 with the aid of a prism 111 and 121, respectively, which is positioned between controllable light 20 source 21 and display layer 14. Prism 111 of rotary knob 110 has a flat reflecting surface 113, while prism 121 of rotary knob 120 has a curved reflecting surface 123.

Fig. 19 shows illustrates a cross-section of an exemplary 25 embodiment of an operator device 130 for operating a motor vehicle. Fig. 20 shows is a rear view of the exemplary embodiment of operator device 130. The operator device has rotating bodies 12 and 212, which have display layers 14 and 214, may be used functionally independently from each other, 30 and are situated at a distance d3, e.g., between 3 cm and 10 cm away from each other. Rotating body 212 has an at least partially transparent display layer 214, which rotates along in response to an angular movement of rotating body 212. Display layer 214 has a side 215 facing an operator and a side 35 216 facing away from the operator, as well as a side wall 217.

Different information is simultaneously displayable on display layers 14 and 214 of rotating bodies 12 and 212. ~~in accordance with the present invention, the~~ ~~The~~ same time can may mean the 5 same time in the strict sense of the word, but the same time ~~in the sense of the present invention can~~ may also include different points in time, which are, however, so close together that the human eye perceives images, which it sees at these different points in time, as simultaneously displayed 10 images.

Together with controllable light source 21 and mirrors 131 and 141, rotating bodies 12 and 212 form rotary knobs, which have a common, controllable light source 21 for displaying, ~~in~~ 15 ~~particular e.g.,~~ different information on their display layers 14 and 214. As shown illustrated in Fig. 19, mirrors 131 and 141 are slightly inclined, so that upper side 140 of mirror 131 and lower side 142 of mirror 141 are visible. In addition, mirrors 131 and 141 are offset from each other, as shown 20 illustrated in Fig. 20. In this manner, the two display layers 14 and 214 are simultaneously swept over by light beam 132 ~~in the sense of the present invention.~~ If light beam 132 is moved far enough to the right with respect to Fig. 20, it follows dotted line 133, so that display layer 214 is swept 25 over.

In conjunction with a scattering lens, rotary knobs 90, 100, 110, and 120 ~~according to~~ illustrated Fig. 15, Fig. 16, Fig. 17, and Fig. 18, and the operator device ~~according to~~ 30 illustrated Fig. 19 and Fig. 20, may be designed arranged in accordance with the exemplary embodiment [[of]] illustrated in Fig. 4.

The elements features and layers in the figures are drawn with 35 simplicity and clarity in mind, and not necessarily to exact

scale. Thus, the orders of magnitude of certain elements or layers are depicted with considerable exaggeration as compared to other elements features or layers, in order to improve understanding of the exemplary embodiments of the present invention.

List of Reference Numerals

LIST OF REFERENCE NUMERALS

1	motor vehicle
2	steering wheel
5 3	display
4	console
5, 6, 10, 20, 30,	
90, 100, 110, 120	rotary knob
7	edge
10 8	operating elements
11	light source
12, 62, 72, 82, 212	rotating body
13	template
14, 64, 74, 84, 214	display layer
15 15, 215	a side facing the operator
16, 216	a side facing away from the operator
17, 217	side wall
18	axis of rotation
19, 21	controllable light source
20 22, 92, 102, 112,	
122, 132	light beam
23, 41	control unit
24	laser
31	scattering lens
25 33	double arrow
40	multifunction operating device
50	telephone screen form
51	menu line
91, 101, 131, 141	mirror
30 111, 121	prism
113, 123	reflecting surface
130	operator device
133	dotted line
140	upper side
35 142	lower side

d1, d2, d3

distance

Abstract

ABSTRACT

The present invention relates to a **A** rotary knob ~~(5, 6, 10, 20, 30, 90, 100, 110, 120)~~ **is** for operating a motor vehicle
5 **(1)** by rotation of the rotary knob ~~(5, 6, 10, 20, 30, 90, 100, 110, 120)~~, the rotary knob ~~(5, 6, 10, 20, 30, 90, 100, 110, 120)~~ having an at least partially transparent display layer
~~(14, 214)~~ which rotates along in response to an angular movement of the rotary knob ~~(5, 6, 10, 20, 30, 90, 100, 110, 120)~~, and a controllable light source ~~(19, 21)~~ for displaying changeable information on the display layer ~~(14, 214)~~.

~~(Figure 3)~~